Sub a3

I claim:

1. An apparatus for measuring displacement, the apparatus comprising:

a machine element having an interior wall and an exterior wall and further having a first end wall substantially enclosing the interior wall and the exterior wall;

a shaft element movable within the machine element;

a head element attached to the shaft element adjacent to the interior wall of the machine element;

a light source attached to the machine element; and

a sensor attached to the machine element and positioned to detect intensity of light within the machine element.

2. The apparatus of Claim 1 further comprising:

a coating on the shaft element.

3. The apparatus of Claim 1 further comprising:

a coating on the interior wall of the machine element.

4. The apparatus of Claim 1 further comprising:

a seal disposed around the shaft element.

5. The apparatus of Claim 1 further comprising:

a second end wall opposite to the first end wall wherein the second end wall has a groove.

6. The apparatus of Claim 1 further comprising:

a first brush positioned at the end wall of the machine element.

7. The apparatus of Claim 6 wherein the first brush is constructed from wire.

8. The apparatus of Claim 1 further comprising:

a second brush positioned at the end wall of the machine element.

9. The apparatus of Claim 8 wherein the second brush is constructed from bronze.

10. The apparatus of Claim 1 further comprising:

A3 Cont'd

an additional sensor attached to the machine element and positioned to detect intensity of light within the machine element.

11. An apparatus for cleaning a machine component, the apparatus comprising:

a machine element having an interior wall and an exterior wall and further having an end wall substantially enclosing the interior wall and the exterior wall;

a shaft element movable within the machine element;

a head element attached to the shaft element and adjacent to the interior wall of the machine element; and

a first brush positioned at the end wall of the machine element in contact with the shaft element.

12. The apparatus of Claim 11 further comprising:

a seal disposed around the shaft.

13. The apparatus of Claim 11 further comprising:

a coating on the shaft element.

14. The apparatus of Claim 11 further comprising:

a second brush positioned at the end wall of the machine element.

15. The apparatus of Claim 11 further comprising:

a light source attached to the machine element.

16. The apparatus of Claim 11 further comprising:

a sensor positioned to receive reflected light within the machine element.

17. A method for measuring displacement of a machine element, the method comprising the steps of:

providing a machine element having an interior and an exterior wall and further having an end wall;

providing a shaft element capable of movement within the machine element;

attaching a head element to the shaft element;

positioning the head element adjacent to the interior wall of the machine element;

attaching a light source to the machine element;

attaching a sensor to the machine element; and

A3 Cont'd

measuring intensity of light within the machine element from reflected light detected by the sensor.

18. The method of Claim 17 further comprising the steps of:

moving the shaft element; and

producing an output signal as the shaft element moves within the machine element.

19. The method of Claim 17 further comprising the steps of:

providing a processing unit that receives the output signal; and

displaying the output signal.

20. The method of Claim 17 further comprising the step of:

positioning a seal at the end wall of the machine element.

21. The method of Claim 17 further comprising the step of:

attaching a first brush to the machine element.

22. The method of Claim 17 further comprising the step of:

attaching a second brush to the machine element.